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Technical Field

The present invention relates to automatic vending systems and, more particularly, to automatic controlled drug dispensing apparatus.

Background Art

The delivery of controlled substances to patients in a hospital or other medical care environment has long been the subject of attempts at improvement. Initially, the controlled substances were shipped to medical facilities packaged in containers, such as bottles, jars, and the like. These containers were stored at a central pharmacy location. When a doctor required administration of a dose of a controlled substance to a patient, a prescription was written and a nurse was responsible for obtaining the dosage from the pharmacy and administering it to the patient.

In order to effectuate proper inventory control as well as improve security with regard to the controlled substance, the pharmacy was required to manually log the identity of the nurse receiving the medication, the type of medication dispensed, the amount of medication dispensed, the time of release of the medication, and other information necessary for proper inventory control. The nurse was also required to manually record the medication received, the amount of medication delivered, the patient to whom the medication was delivered, and the time the patient received the medication. Furthermore, if the controlled substance was subsequently delivered to the patient after the original nurse's shift was over, the additional nurse would be required to manually record the same type of information regarding her handling of the medication. Thus, it is seen that the administration of a controlled substance to a patient is both labor and time intensive as a commitment of a number of individuals as well as the time involved in manually recording the information regarding the distribution of the medication is required.

More recently, the containers of drugs have been remotely located within the medical facility at stations closer to the patients receiving the medication. In this system, while the pharmacy releases the containers of medicine to the various nurse substations, the inventory information is still required to be recorded. The containers of medicine are then stored behind locked cabinets at each nurse substation with the nurses retrieving the drug from the locked cabinet and administering the drugs to the patients. Of course, the nurses are still required to record the detailed information regarding the types of medication, the amount of medication, the time of administering medication, and other information regarding the administration of the medicine.

While this system of administration more quickly brings the controlled substance to the patient, it suffers from the same drawbacks of the previous system of being labor and time intensive as well as the additional drawback of reducing the security of the controlled substances while they are at the remote locations.

In an effort to improve these systems, various devices have been designed for distributing unit dose medication from an apparatus. While these various apparatus are an improvement over the manual systems previously discussed, such systems are exceedingly large, therefore requiring use in a centralized dedicated location, require use of pharmacy resources and time to properly load and inventory machines, and are dedicated to specific forms of drug to be dispensed. An example of a device in which more than one drug can be dispensed is found in JP-A-60-82130, which discloses a tablet delivery apparatus including a unit for inputting information regarding the tablets to be supplied. This information is compared to information from a recognising device found at the end of each delivery means to drive the delivery means corresponding to the information supplied. What is needed, is a relatively portable drug dispensing apparatus which provides a high level of security for the drugs being dispensed, is sufficiently flexible to all distribution of drugs of varying dosage formats, is easily reloaded with new drug, and reduces the labor and time drawbacks of the prior art. The present invention fulfils these requirements.

Disclosure of Invention

The present invention provides for a drug dispensing device which is portable, provides a high level of security, is flexible in accommodating a number of user selected drugs, is easily stackable, and reduces labor and time requirement for drug dispensing. According to the present invention there is provided a drug dispensing apparatus comprising:

microprocessing means; and

a housing defining an interior medication storage area, containing a plurality of dispensers the interior medication storage area including means for receiving a plurality of different sized dispensers in multiple orientations, the receiving means including means for establishing electrical communication between the dispensers and th microprocessing means; and a receiving drawer is oriented below the interior medication storage area to receive and dispense medication, each dispenser

including actuating means operable to discharge medication therefrom into the receiving drawer.

The dispensers provided can be configured in a multiplicity of sizes and shapes to accommodate different sized medications. At least one dispenser is preferably adapted to receive a cooperating cartridge which contains the medications.

Brief Description of the Drawings

Figure 1 is a perspective view of a device made in accordance with the principles of the present invention;

Figure 2 is a partially cut-away overhead view of the device of Figure 1 taken along the line II-II in Figure 1;

Figure 3 is an elevational front view of a dispenser;

Figure 4 is a cut-away view taken along the line V-V of Figure 3;

Figure 5 is an elevational front view of a cartridge;

Figure 6 is a cut-away, elevational side view of the cartridge of Figure 5 taken along the line VI-VI in Figure 5;

Figure 7 is a bottom view of the cartridge of Figure 5;

Figure 8 is a detailed side elevational view of the retainer of Figure 5;

Figure 9 is a cut-away side view of the retainer of Figure 8 taken along the line IX-IX of Figure 8;

Figure 10 is a cross sectional cut-away view similar to Figure 4 showing the cartridge of Figures 5, 6 and 7 in the dispenser of Figures 3 and 4;

Figure 11 is a partially cut-away overhead view similar to Figure 2 showing the cartridge of Figure 5, 6 and 7 the dispenser of Figures 3 and 4 in the apparatus of Figure 1;

Figure 12 is a flow diagram showing the preferred method of dispensing in accordance with the principles of the present invention,

Figure 13 is a front view of the apparatus of Figure 1;

Figure 14 is a side view of the apparatus of Figure 1;

Figure 15, Figure 16 and Figure 17 are a side view, a plane view and a cut-away view of the dispenser making one body together with the cartridge, respectively;

Figure 18 is a partially cut-away perspective view of an actuator; and

Figure 19 is a block diagram of a control unit.

Best Mode for Carrying Out the Invention

Referring to Figure 1, a drug dispensing device made in accordance with the principles of the present invention is designated generally by figure 10. The drug dispensing device 10 includes housing 12 employing a generally rectangular box shape. The drug dispensing device 10 includes a front 14 and a rear 16, two sides 18, 20, and a top 22 and bottom 24. The drug dispensing device 10 is contained in a small area with the presently preferred embodiment being approximately 30 inches (76.2 cm) wide, 20 inches (50.8 cm) tall and 20 inches (50.8 cm) deep. Thus, the presently preferred device 10 can readily be placed on a countertop at remote substations. Additionally, the device 10 can also be placed on a dedicated stand or wall mounted if counter space is not available. It will be seen that all of the advantageous features described herein can be contained in a device 10 employing these dimensions.

The front 14 of the device 10 contains a locked dispensing drawer 28 which provides access to the dispensed medicines. When access is allowed, as explained in detail below, a locking latch mechanism is released and the drawer 28 can be pulled into the open position. The drawer 28 can be controlled manually or automatically in the movement. An example of the automatic control is shown in Figures 13 and 14. As shown in the Figures, the drawer 28 is fixed above the two belts 213 and automatically slides a designated amount in and out of the device 10. The drive unit for the drawer 28 is comprised of the motor 214 which operates as a result of signals issued from the microprocessing means 26 described later, the roller 215 which rotates on the motor shaft, the pressure roller 217 which is pressed by shaft 216 against the roller 215, two drive rollers 218 which are fixed to the two ends of the aforementioned shaft 216 and which revolve together with the pressure roller 217, two idling rollers 219 installed opposite to the two drive rollers 218, and the two belts 213 which are stretched between the two drive rollers 218 and the two idling rollers 219. The drawer 28 can move together with the two belts 213 on which it is fixed. The drawer 28 is formed in the dimension which corresponds to two files of the dispenser 60 described later in width and three ranks of the dispenser 60 in depth, i.e. in the dimension less than a half of the plane area of the device 10.

When the user designates a type and quantity of desired medications into the later-described input unit 248 of the control device 300, the said medications drop from their cartridges 90 into the drawer 28 as follows: Based on the information provided to the input unit 248 of the control device

300, the drawer 28 automatically moves forward or back the distance required to locate it underneath the dispenser 60 containing the designated medications. In this way, the drawer 28 can be constructed compactly while still servicing all of the dispenser 60, reducing the amount of space required for the drawer 28 to protrude from the device 10 and serving to reduce the overall space required for the device. Further, a slanted guide plate 220 is fitted to the rear of the drawer 28 in order to cause medications dropped from the cartridges 90 to be located toward the front of the drawer 28, thus facilitating removal of the medications from the drawer 28.

A user interface screen 30 which is in communication with microprocessing means 26 (shown in phantom in Figure 2) and which employs touch sensitive features known in the art is further provided as the input unit 248 on the front 14 of the device 10 to allow the user to communicate with the microprocessing means 26. The microprocessing means 26 can preferably be a type XT, AT or PS/2 Personal Computer manufactured by IBM Corporation, Boca Raton, Florida 33429. A card reader 32 known in the art is further provided having a slot 34 into which a magnetic identification card is inserted or "swiped" to gain access to the microprocessing means 26 programs. A suitable card reader 32 can preferably be a MP2A manufactured by Tokyo Tatsuo Corporation, Tokyo, Japan.

Floppy disc unit 301 which memorizes the driving system of the device is further provided.

Thus, to initiate use of the device 10, a designated individual having access is assigned a magnetic, optical or integrated circuit identification card and a personal identification number (PIN). When the user desires to dispense medication, for example, the user initiates dispensing by inserting an identification card into the card reader 32, upon which the microprocessing means 26 of the present device 10 requests the user to input a personal identification number (PIN). The user's personal identification number (PIN) is then inserted into the microprocessing means 26 via the user interface touch screen 30 and, if the personal identification number (PIN) and the identification card are a match, the dispensing can proceed as will be described in more detail below. Alternatively, a finger print or retina scan device can be utilized particularly when extremely sensitive drugs are stored in the device 10.

The front of the device 10 further contains a rejection port 302 for output of a print.

One side 20 of the device 10 is provided as a door 38 which is hingedly secured to the housing 12 and includes a locking latch mechanism to secure the door 38 in the closed position. Thus, an individual such as a pharmacist or mechanic who is allowed access to the interior of the device 10 is identified through an identification card and personal identification number (PIN), the door 38 can be opened through user interface with the touch screen 30 and microprocessing means 26 to gain access to the interior of the device 10 for servicing or return drug removal.

The top 22 of the device 10 is provided with a medication access door 40. The medication access door 40 is hingedly secured to the housing and includes a locking latch mechanism to control access. Once again, when a user such as a pharmacist designated to stock and configure the device 10 is identified through an identification card and personal identification number (PIN), the locking mechanism releases and access to the interior of the device 10 can be gained.

The top 22 further includes a first auxiliary door 42 which allows access to an interior storage compartment when the user desires to return medication. The first auxiliary door 42 is secured by a locked latch mechanism. The first auxiliary door 42 can be opened in response to a request by a user to return unused drugs. When the user has logged the drug being returned from the input unit 248, the locked latch machanism releases the first auxiliary door 42, which can then be opened, the drug is inserted, and the user then closes the first auxiliary door 42 into a secure latched engagement. Because of the storage of returned drugs, the first auxiliary door 42 can preferredly include a secured double walled configuration such as a trap door leading to a second service storage area which prevents subsequent access to the previously returned drugs. An example of the construction of the first auxiliary door 42 is shown in Figure 13, the first auxiliary door 42 has a fall-away lower floor plate 222 which is hinged at its front edge. When the door is in the extended (open) position, the floor plate serves as a normal bottom to the door, but when the door is in the retracted (closed) position, the floor plate 222 drops downward at its hinge as shown at the two-dot chain line in Figure 13, thus operating as a vertical trap door. A receptacle 223 is provided beneath the first auxiliary door 42.

Further provided on the top 22 of the device 10 is a second auxiliary door 44 which allows access to a universal compartment of size and configuration sufficient to allow storage of oddly sized medications which do not fit into a dispenser 60 and cartridge 90 of the present device 10. Once again, the second auxiliary door 44 is secured by a locked latch mechanism and access to the universal compartment is achieved by a user requesting dispensing of a medication previously identified in the microprocessing means 26 as found in the universal compartment.

Referring now to Figure 2, a cut-away top view of the device 10 is seen showing the medication storage area. In this view, the medication storage area contains neither dispensers 60 nor cartridges 90 needed to actuate dispensing of the medications.

A printed circuit board 50 is provided which defines two apertures 52, 54 sized to allow free fall to the secured dispensing drawer 28. The dispensing drawer 28 is provided with padding on the interior surface to gently break the free fall of drug containers.

Further provided in the printed circuit board 50 are a plurality of female electrical connectors 56 which can be an 8 circuit type located at standard intervals on the circuit board 50 about the perimeter of the defined apertures 52, 54. The female electrical connectors 56 are electronically connected with the microprocessing means 26 as well as an electrical power source (not shown) to provide both electrical power to the device 10 as well as electrical communication with the microprocessing means 26.

Additionally, while the female electrical connectors 56 are standard spaced to accommodate the smallest sized dispensers 60, a plurality of differently sized dispensers 60 are provided adapted to be mated with the female electrical connectors 56, as will be described in detail below. Thus, a user can select from a variety of sized dispensers 60 to dispense medication in accordance with the specific needs of the users of the device 10.

Referring now to Figures 3 and 4, a dispenser 60 made to be inserted into the medication storage area is seen. The dispenser 60 includes dispenser housing 62 defining an interior space 64 sized to receive a cartridge 90 as will be described in detail below. An optical sensor 66 is provided on the dispenser housing 62 to monitor the dispensing of the medication.

A solenoid 68 (which may be substituted by a motor) is provided on the exterior of the dispenser housing 62. Solenoid 68 includes a reciprocating piston 70 which is operatively connected to rotating linkage 72 which is contained on a pivot rod 74. The pivot rod 74 is rotatably journaled in the dispenser housing 62. Upon actuation, the solenoid piston 70 is retracted by the solenoid 68 whereupon the rotating linkage 72 causes rotation of pivot rod 74.

Contained offset from the bottom of the dispenser 60 is a surrounding support lip 76 which rests against the printed circuit board 50 to support the dispenser 60. Contained on the support lip 76 and extending downward from the support lip 76 is a male electrical connector 78 which can be 8-pin quick connect type which can be cooperatively connected to the female electrical connector contained in the printed circuit board 50. The male electrical connector 78 is electronically connected with the solenoid 68 and the optical sensor 66. Thus, as previously seen, when an electrical connection is made, power is supplied to the solenoid 68 and the optical sensor 66 and electronic communication is established between the solenoid 68, optical sensor 66 and the microprocessing means 26.

Referring now to Figure 4, an elevated cutaway view of the dispenser 60 is seen. Pivot rod 74 is secured to a generally L-shaped, stepped actuator arm 82. The generally L-shaped, stepped actuator arm 82 extends downwardly from the pivot rod 74 with a stepped portion 84 being contained near the bottom of the dispenser 60.

As shown in Figure 18, the stopper 241 of an ejector 239 is engaged to the cutaway 240 in the stepped portion 84, the ejector 239 which has a portion 242 retaining medication containers 108 is secured to the actuator arm 82.

The bottom of the dispenser 60 includes a dispensing platform 86 juxtaposed relative to the interior space 64. The receiving platform 86 defines an aperture 88 which extends across the entire width of the dispenser 60 and is offset from the longitudinal axis of the interior space 64. The optical sensor 66 is located juxtaposed over the defined aperture 88.

Referring now to Figures 5, 6 and 7, a cartridge 90 to be inserted into the dispenser 60 is seen. The cartridge 90 is sized to cooperatively slide into the interior space 64 of the dispenser 60. The cartridge 90 includes front 92, back 94 and side walls 96, as well as a top 98. On the front 92 of the cartridge 90 extending upwardly from the open bottom 100, a rectangular cut-out 104 is defined.

Thus, the cartridge 90 defines an enclosed interior storage area 102 having an open bottom 100. Defined on the interior surface of the front 92 and back 94 wall are a plurality of inwardly projecting ribs 106. The inwardly projecting ribs 106 are oriented on a horizontal arrangement to help orient the falling medication containers which are stored and dispensed from the cartridges explained in detail below.

In another embodiment, a dispenser and a cartridge may be formed in one body. For example, as shown in Figure 17, the dispenser 60 itself serves for a cartridge. In this case, ribs 106 are provided on the two sides 304, 305 of the dispenser 60.

Contained in the interior storage space 102 are a plurality of stacked medication containers 108. While the embodiment depicted in Figures 5, 6 and 7 contain syringes or vials, it will be appreciated that various medication containers such as for example, oral solids, ampules, liquid cups, and the

like, can readily be contained in dedicated cartridges 90 by altering the proportions of the cartridge 90 and dispenser 60.

In transportation, storage and loading, the medication containers 108 are prevented from falling out the open bottom 100 by means of a retaining member 110. The retaining member 110 defines an upper and lower periphery and is generally an inverted T-shape with an expanded width area 112 found at the lower periphery. The expanded width area 112 corresponds in size to the rectangular cut-out 104 defined on the front 92 of the cartridge 90.

Referring to Figures 8 and 9, the retaining member 110 is seen in detail. The expanded width area 112 includes at its lower periphery an L-shaped portion 114 which extends into the rectangular cut-out 104. Thus, the medication containers 108 abut against the L-shaped portion 114 which acts to contain the medication containers 108 within the interior storage area 102.

The upper periphery of the retaining member 110 includes an outwardly extending flange 118 to enable the user to grip and pull the retaining member 110. The retaining member 110 is secured to the front 92 of the cartridge 90 by a pair of adhesives 120, 122, 123 securing the retaining member 110 near its upper and lower periphery.

A wire 124 is further provided extending through the adhesive 120 located near the upper periphery of the retaining member 110 and through a pair of apertures 126,128 defined in both the front 92 and back 94 of the cartridge 90. Retaining member 110 is utilized to indicate tampering. Thus, prior to loading the medication containers 108 into the dispenser 60, the user must disengage the wire 124 thus providing evidence of use. In addition, as best seen in Figure 6, the wire 124 extends directly over the medication containers 108 stored in the interior storage space 102. Thus, the wire 124 additionally maintains the medication containers 108 within the interior space 102 to prevent damage during transportation and storage.

The cartridge 90 can preferably be made from a rigid metal such as aluminum. The retaining member 110 can preferably be made of a semi-rigid thin material such as spring steel which is sufficiently rigid to prevent access to the medication containers 108. While the cartridge 90 can be filled by a pharmacist at the hospital or other medical facility, the cartridge 90 is preferably filled in an automated process at a centralized location from distribution pre-filled to users.

Referring now to Figure 10, an elevational cross sectional view similar to that seen in Figure 4 in which a cartridge 90 has been inserted into a dispenser 60 is seen. Upon insertion of the cartridge 90, the user grasps the flange 118 and pulls the retaining member 110 to allow fre fall of the medication containers 108 to the dispensing platform 86. Upon actuation of the solenoid 68 and resultant pivot of the pivot rod 74, the stepped actuator arm 82 rotates counter-clockwise with the stepped portion 84 contacting the medication container 108 resting on the dispensing platform 86 and urging the medication container 108 towards the aperture 88. Those movements are shown by arrows in Figures 15 and 17. When the medication container 108 is urged to a position over the aperture 88, gravity induces it to fall, which passage is sensed by the juxtaposed sensor 66 and relayed to the microprocessing means 26.

When the medication container 108 is urged from the dispensing platform 86, gravity pulls the remaining medication containers 108 toward the dispensing platform 86. While the stepped actuator arm 82 is maintained by the solenoid 86 in a counter-clockwise position, the remaining medication containers 108 fall against a generally horizontal portion of the stepped portion 84 of the stepped actuator arm 82 which prevents additional medication containers 108 from dispensing. Upon rotation of the stepped actuator arm 82 in a clockwise direction to its original position, the medication containers 108 free fall and rest against the dispensing platform 86 in position for the next dispensing. The dispensed medication container 108 free falls past the respective defined apertures 52, 54 in the printed circuit board 50 into the drawer 28 for access by the user.

Referring to Figure 11, an overhead view of device 10 having dispensers 60 and cartridges 90 within the medication storage area is seen. By standardizing the female electrical connectors 56 on the printed circuit board 50 and the male electrical connectors 78 on a variety of different sized dispensers 60 and cartridges 90, a plurality of different sized medication containers 108 can be user selected. For example, a standard small size can be utilized for 2. cc ampules. An enlarged small size can be utilized for larger 10. cc ampules.

Additionally, if smaller medication containers 108 are utilized such as, for example, 2 ml vials, dual dispensers 132 can be utilized having two solenoids 68, two optical sensors 66, two interior spaces 102 defined to receive two cartridges 90, etc., and two male electrical connectors 78 to mate with two cooperating female electrical connectors 56. Finally, if cup-form medication dispensers are desired, for oral liquid medications, for example, a tri-dispenser 134 can be utilized having three solenoids 68, three optical sensors 66, three interior spaces 102 defined to receive three cartridges 90, etc., and three male electrical connectors 78 to mate with three female electrical connectors 56.

Thus, the user can select any desired combination to dispense a vast variety of different type medication dispensers 108 and thus medications. Once the desired combination is determined, a pharmacist or mechanic can input which female electrical connector 56 is dedicated to control the dispensing along with additional inventory information into the microprocessing means 26.

Next we will describe the control unit 300. As indicated in Figure 19, the control unit 300 is composed of the identification unit 247, which uses passwords, IC cards or similar means to allow individual identification of users; the input unit 248, which is used to input the type and number of medications to be dispensed from the device 10; the memory unit 249, which records data input to the input unit 248; the display unit 250 which displays data input to the input unit 248, data recorded in the memory unit 249, and feedback information from the device 10; and the microprocessing means 26, which uses information designated in the input unit 248 to provide drive control for the automatic dispensing of the desired type and number of medications from the device 10, as well as control operation of the drawer 28 and the locks. For example, while the use of a card reader employing an IC card or magnetic card has been described in the identification section 247, it should be clear that other kinds of identification methods, including passwords, fingerprints, voice identification, hand prints (three-dimensional), signs and other such methods can also be used, in any case so as to make it impossible for unauthorized personnel to operate the automatic dispenser for injectable medications.

Also, while the identification section 247, input section 248 and display section 250 can make use of a commercially available personal computer or other like device, other devices specially designed for the purpose may also be incorporated into the device 10.

Referring now to Figure 12, a preferred embodiment of the method of operation is depicted. The present system is designed for either stand alone use or networked with a host computing means in a central location such as a pharmacy. In the event the unit is networked, data such as patient profiles, stock levels, and the like can be provided by the host computing means to the units.

To operate the device, initially the user inserts a magnetic identification card which is read or "swiped" by the card reader. The user interface screen then asks for the user's personal identification number (PIN). If the user inserted personal identification number (PIN) matches the card read, access is allowed and a menu is displayed.

In the presently preferred embodiment, seven routines, including Dispense, Reconfigure, Restock, Return, Order, Mainenance and Exit are provided. The microprocessing means will allow access to the different routines in accordance with preprogrammed user level of access. For example, a nurse may have access to the Dispense, Order, Return and Exit routines, but not the Reconfiguration or Restock routines, A pharmacist may have access to the Restock, Reorder, and Exit routines, but not the Dispense, Reconfigure or Return routines. A service person such as a hospital biomedical engineer may have access to the Reconfigure, Maintenance and Exit routines, but not the Dispense, Order, Restock or Return routines. Access can be preprogrammed in accordance with hospital policy.

If the properly identified user desires access to the Dispense routine, the user selects from the menu on the touch screen the Dispense routine. The user interface screen then asks for and the user identifies inventory control information such as the type of drug, patient information, and any other inventory controls. Additional data such as time from a clock means in the microprocessing means can also be added.

After the inventory controls are inputted, the microprocessing means activates the appropriate solenoid via the female electrical connector to dispense the selected drug. Alternatively, if the selected drug is contained in the universal compartment, the locking latch mechanism is released to allow user access.

After the appropriate solenoid has been activated and the medication container has fallen into the dispensing drawer, the locking latch mechanism which closes the dispensing drawer is released which allows the dispensing drawer to be opened. The user can then withdraw the dispensed medication container.

Following withdrawal of the dispensed medication container, the user manually closes the dispensing drawer. The locking latch mechanism secures the drawer and communicates to the microprocessing means that the door has been closed. Alternatively, if the universal compartment has been utilized, the user closes the universal compartment drawer with that locking latch member indicating to the microprocessing means that the door has been closed.

The transaction is then recorded in random access memory (RAM) in the microprocessing means for inventory control purposes. In an alternative preferred embodiment, the microprocessing means can be interfaced with a dedicated printer to provide a physical printout of the transaction in addition to the electronic storage. After recording of the transaction, the microprocessing means returns the user interface screen to the selection menu where the user can continue to an additional routine or select the Exit routine.

If the user selects the Reconfigure routine, the microprocessing means determines whether the user is authorized to continue on that routine. If the user is authorized, the microprocessing means will unlatch the locking latch mechanism on the top door which allows the user to open the door and gain access to the medication storage area. The user then inputs the new dispenser location into the microprocessing means via the touch screen. After inputting the identification of the new dispenser, the user then physically reconfigures the new dispensers. After the new dispensers have been configured, the user then inputs the type of medication to be dispensed at each location. The user then closes the top door and the locking latch mechanism communicates to the microprocessing means to record the reconfigured transaction. The microprocessing means then returns the touch screen to the original menu where an additional routine can be selected.

If the user selects the Restock routine, the microprocessing means first determines whether the user has access to that routine. If the user does have access to that routine, the locking latch mechanism on the top door is unlatched while the locking latch mechanism on the universal storage compartment on the door is simultaneously unlatched. The user then gains access to the drug storage or the universal storage compartment and inserts a full drug cartridge into the appropriate dispensers or adds the dedicated medication to the universal storage compartment. After the universal storage compartment door and the top door have been closed, the transaction is recorded and the microprocessing means returns the interface screen to the original menu.

If the user selects the Return routine, the user interface screen requests appropriate inventory control information such as, for example, the medication, the patient, and the reason for return. Once again, additional information such as time can also be inputted. After the inventory control information has been input into the microprocessing means, the microprocessing means unlatches the locking latch mechanism on the return compartment, therefore allowing the user access. After the user has returned the drug into the return compartment, the closing of the return door signals to the microprocessing means that the return is complete. The transaction is then recorded and the screen is returned to the original menu.

If the user selects the Maintenance routine, the side door is unlocked. This allows access to the return compartment as well as servicing. After maintenance is completed, the user closes the side door and the screen is returned to the original menu.

A drug order routine can also be provided. The drug order routine can automatically track the inventory of drugs. In the event of a stand alone unit, the individual station can generate a report of the use at a dedicated printer. In the event that the units are networked to a host computing means in a central location, such as a pharmacy, a report can be generated at that location. In an alternative embodiment, the system can be designed to automatically signal when a drug quantity reaches a predetermined low level. Of course, if the Exit routine is selected, the microprocessing means and user interface screen return to the original display.

Claims

1. A drug dispensing apparatus comprising:
   microprocessing means (26); and
   a housing (12) defining an interior medication storage area, containing a plurality of dispensers (60), the interior medication storage area including means for receiving a plurality of different sized dispensers in multiple orientations, the receiving means including means for establishing electrical communication between the dispensers and the microprocessing means (26); and a receiving drawer (28) is oriented below the interior medication storage area to receive and dispense medication, each dispenser (60) including actuating means (68) operable to discharge medication therefrom into the receiving drawer.

2. The apparatus of claim 1 wherein the receiving means includes a plurality of spaced electrical connectors (56) in electrical communication with the microprocessing means (26), the electrical connectors being adapted to establish electrical communication with cooperating electrical connectors (78) on the dispensers (60).

3. The apparatus of claim 2 wherein the electrical connectors (56) are contained on a generally horizontally oriented printed circuit board (50), the circuit board defining at least one aperture (52) through which dispensed medications fall.

4. The apparatus of claim 1, 2 or 3 further including a touch panel or a keyboard in electrical communication with the microprocessing means (26).

5. The apparatus of any of claims 1 to 4, further including user identification means (32).

6. The apparatus of claim 5 wherein the identification means (32) is a card reader.

7. The apparatus of any preceding claim further including a storage compartment for a drug in particular shape.

8. The apparatus of any preceding claim further including a return drug storage compartment.

9. The apparatus of any preceding claim wherein the housing is formed from a box structure with an upper opening and a lid (40) which can be opened and closed over the opening, and a control unit (300) is provided with the microprocessing means for controlling the dispensers and the housing, comprised of an identification section (247) utilizing passwords, IC cards or other like identification methods to allow identification of users, an input unit (248) for inputting the type and number of medications to be dispensed from the housing (12), a memory unit (249) for recording the data input unit, and a dispensing section (10) for automatically dispensing the requested type and number of medicines from the housing based on the information designated by the input unit.

10. The apparatus of any preceding claim wherein at least one dispenser houses a cartridge holding medication containers, said dispenser has a gravity fod dispensing platform (86) and an actuator arm (82) for urging medication containers off the dispensing platform, and the cartridge comprises:

a container having a front (92), a back (94), two sides (96), a top (98), and open bottom (100), and defining an interior, the container being sized to accept the medication containers (108) in the interior;

the front (92) of the container having an opening (104) extending upwardly from the open bottom, the front opening being sized to accept a retaining member (110) having a portion (114) extending into the interior of the container to retain the medication containers (108) within the containers; and

the retaining member (110) further being removably secured to the outside of the container and including a portion extending upwardly from the inwardly extending portion such that the retaining member can be removed from the container by pulling the upwardly extending portion.

11. The apparatus of claim 10 wherein the retaining member (110) is generally T-shaped with the inwardly extending portion being an enlarged width area.

12. The apparatus of claim 10 or 11 wherein the container and the retaining member (110) define a plurality of apertures (126,128) through which a wire (124) extends to secure the retaining member to the container.

13. The apparatus of claim 10, 11 or 12 wherein the container is made of metal.

14. The apparatus of claim 10, 11 or 12 wherein the container is made of plastic.

15. The apparatus of claim 10, 11 or 12 wherein the retaining member is made of spring steel.

16. The apparatus of any one of the preceding claims, wherein at least one dispenser comprises:

a dispenser housing (62) defining an interior chamber (64) for receiving a cartridge (90) holding medication containers therein;

the housing further defining a dispensing platform (86) juxtaposed relative to the interior chamber, the dispensing platform defining an aperture (88) offset from the interior chamber;

an electronically activated actuator (68) contained in cooperative relationship to the dispensing platform (86) such that medication containers (108) resting on the dispensing platform can be urged to the defined aperture (88); and

an electrical connector (78) in electronic communication with the actuator (68) and the microprocessing means (26) and adapted to cooperatively secure to the electrical connector (56) in the dispensing device (70).

17. The apparatus of claim 16 wherein the actuator (68) includes a solenoid or a motor.

18. The apparatus of claim 17 wherein the actuator further includes an actuator arms (82) controlled by the solenoid or a motor.

19. The apparatus of claim 16 or 17 further including an optical reader (66) in electronic communication with the electrical connector (78) and positioned over the dispensing platform defined aperture (88).

Patentansprüche

1. Medikamenten-Ausgabevorrichtung, die umfaßt:
eine Mikroverarbeitungseinrichtung (26), und
ein Gehäuse (12), das einen inneren Medikamenten-Speicherbereich festlegt, der eine Mehrzahl von Ausgebern (60) enthält, wobei

der innere Medikamenten-Speicherbereich eine Einrichtung einschließt, die eine Mehrzahl von Ausgebern unterschiedlicher Größe in mehrfachen Ausrichtungen aufnimmt, wobei die aufnehmende Einrichtung eine Einrichtung einschließt, die eine elektrische Verbindung zwischen den Ausgebern und der Mikroverarbeitungseinrichtung (26) herstellt; und ein aufnehmendes Schubfach (28) ist unter dem inneren Medikamenten-Speicherbereich ausgerichtet, um Medikamente zu empfangen und auszuteilen, wobei jeder Ausgeber (60) eine Betätigungseinrichtung (68) umfaßt, um die Medikamente daraus in das aufnehmende Schubfach abzuführen.

2. Vorrichtung nach Anspruch 1, bei der die aufnehmende Einrichtung eine Mehrzahl von beabstandeten elektrischen Steckverbindern (56) in elektrischer Kommunikation mit der Mikroverarbeitungseinrichtung (26) umfaßt, wobei die elektrischen Steckverbinder eingerichtet sind, um eine elektrische Kommunikation mit zusammenwirkenden elektrischen Steckverbindern (78) an den Ausgebern (60) herzustellen.

3. Vorrichtung nach Anspruch 2, bei der die elektrischen Steckverbinder (56) auf einer in allgemeinen horizontal ausgerichteten gedruckten Leiterplatte (50) enthalten sind, wobei die Leiterplatte wenigstens eine Öffnung (52) definiert, durch die die ausgegebenen Medikamente fallen.

4. Vorrichtung nach Anspruch 1, 2 oder 3, weiter umfassend eine Berührungsplatte oder eine Tastatur in elektrischer Kommunikation mit der Mikroverarbeitungseinrichtung (26).

5. Vorrichtung nach einem der Ansprüche 1 bis 4, die weiter eine Benutzeridentifikationseinrichtung (32) umfaßt.

6. Vorrichtung nach Anspruch 5, bei der die Identifikationseinrichtung (32) ein Kartenleser ist.

7. Vorrichtung nach einem der vorangehenden Ansprüche, weiter umfassend ein Speicherfach für ein Medikament in besonderer Form.

8. Vorrichtung nach einem der vorangehenden Ansprüche, weiter umfassend ein Speicherfach für zurückgegebene Medikamente.

9. Vorrichtung nach einem der vorangehenden Ansprüche, bei der das Gehäuse aus einem Kastenaufbau mit einer oberen Öffnung und einem Deckel (40) gebildet ist, der über der Öffnung geöffnet und geschlossen werden kann, und eine Steuereinheit (300) mit der Mikroverarbeitungseinrichtung versehen ist, um die Ausgeber und das Gehäuse zu steuern, die aus einem Identifikationsteil (247), der Paßwörter, IC-Karten oder andere ähnliche Identifikationsverfahren benutzt, um die Identifikation von Benutzern zu gestatten, einer Eingabeeinheit (248) zum Eingeben des Typs und der Anzahl der von dem Gehäuse (12) auszugebenden Medikamente, einer Speichereinheit (249) zum Aufzeichnen der Dateneingabeeinheit sowie aus einem Ausgabeteil (10) besteht, der auf der Basis der durch die Eingabeeinheit bestimmten Information die geforderte Art und Anzahl von Medikamenten automatisch aus dem Gehäuse ausgibt.

10. Vorrichtung nach einem der vorangehenden Ansprüche, bei der wenigstens ein Ausgeber eine Kassette unterbringt, die Medikamentenbehälter hält, wobei der Ausgeber eine schwerkraftgespeiste Ausgabeplattform (86) und einen Betätigungsarm (82) besitzt, um die Medikamentenbehälter von der Ausgabeplattform wegzudrängen, und die Kassette umfaßt:
einen Behälter, der eine Vorderseite (92), eine Rückseite (94), zwei Seitenwände (96), eine Obersoite (98) und einen offenen Boden (100) besitzt und ein Inneres definiert, wobei der Behälter bemessen ist, um die Medikamentenbehälter (108) in dem Inneren aufzunehmen;
wobei die Vorderseite (92) des Behälters eine Öffnung (104) besitzt, die sich von dem offenen Boden aufwärts erstreckt, die Vorderöffnung bemessen ist, um ein Rückhalteelement (110) mit einem Teil (114) aufzunehmen, der sich in das Innere des Behälters erstreckt, um die Medikamentenbehälter (108) in da Behälter zurückzuhalten, und
das Rückhalteelement (110) weiter an der Außenseite des Behälters abnehmbar befestigt ist und einen Teil umfaßt, der sich von dem nach innen verlaufenden Teil aufwärts erstreckt, so daß das Rückhalteelement durch Ziehen an dem sich aufwärts erstreckenden Teil aus dem Behälter entfernt werden kann.

11. Vorrichtung nach Anspruch 10, bei der das Rückhalteelement (110) im allgemeinen T-förmig ist, wobei der sich nach innen erstreckende Teil ein Bereich vergrößerter Breite ist.

12. Vorrichtung nach Anspruch 10 oder 11, bei der der Behälter und das Rückhalteelement (110) eine Mehrzahl von Öffnungen (126, 128) definieren, durch die ein Draht (124) verläuft, um das Rückhalteelement an dem Behälter zu be-

festigen.

13. Vorrichtung nach Anspruch 10, 11 oder 12, bei der der Behälter aus Metall besteht.

14. Vorrichtung nach Anspruch 10, 11 oder 12, bei der der Behälter aus Plastik besteht.

15. Vorrichtung nach Anspruch 10, 11 oder 12, bei der das Rückhalteelement aus Federstahl besteht.

16. Vorrichtung nach einem der vorangehenden Ansprüche, bei der wenigstens ein Ausgeber umfaßt:
ein Ausgebergehäuse (62), das eine Innenkammer (64) definiert, um eine Kassette (90) aufzunehmen, die darin Medikamentenbehälter hält;
wobei das Gehäuse weiter eine in bezug auf die Innenkammer nebeneinandergestellte Ausgabeplattform (86) definiert, wobei die Ausgabeplattform eine von der Innenkammer versetzte Öffnung (88) definiert;
einen elektronisch aktivierten Betätiger (68), der in zusammenwirkender Beziehung zu der Ausgabeplattform (86) enthalten ist, so daß die auf der Ausgabeplattform ruhenden Medikamentenbehälter (108) zu der definierten Öffnung (88) gedrängt werden können, und
einen elektrischen Steckverbinder (78) in elektronischer Kommunikation mit dem Betätiger (68) und der Mikroverarbeitungseinrichtung (26) und eingerichtet, um mit dem elektrischen Steckverbinder (56) in der Ausgabevorrichtung (70) zusammenwirkend verbunden zu werden.

17. Vorrichtung nach Anspruch 16, bei der der Betätiger (68) ein Solenoid oder einen Motor umfaßt.

18. Vorrichtung nach Anspruch 17, bei der der Betätiger weiter einen Betätigungsarm (82) umfaßt, der durch das Solenoid oder einen Motor gesteuert wird.

19. Vorrichtung nach Anspruch 16 oder 17, weiter umfassend einen optischen Leser (66) in elektronischer Kummunikation mit dem elektrischen Steckverbinder (78) und über der von der Ausgabeplattform definierten Öffnung (88) plaziert.

Revendications

1. Appareil de distribution de médicaments, comprenant :
   - un microprocesseur (26) ; et
   - un boîtier (12) qui définit une zone intérieure de stockage de médicaments qui contient une pluralité de distributeurs (60), la zone ultérieure pour le stockage de médicaments comprenant des moyens pour recevoir une pluralité de distributeurs de tailles différentes sous des orientations multiples, les moyens de réception comprenant des moyens pour établir une communication électrique entre les distributeurs et le microprocesseur (26) ; et un tiroir récepteur (28) orienté au-dessous de la zone intérieure de stockage de médicaments pour recevoir et pour distribuer des médicaments, chaque distributeur (60) comprenant des moyens d'actionnement (68) susceptibles d'être actionnés pour décharger des médicaments depuis ce distributeur vers le tiroir récepteur.

2. Appareil selon la revendication 1, dans lequel les moyens de réception comprennent une pluralité de connecteurs électriques espacés (56) en communication électrique avec le microprocesseur (26), les connecteurs électriques étant adaptés à établir une communication électrique avec des connecteurs électriques coopérants (78) sur des distributeurs (60).

3. Appareil selon la revendication 2, dans lequel les connecteurs électriques (56) sont contenus sur une carte à circuits imprimés (50) orientée généralement horizontalement, la carte à circuits imprimés définissant au moins une ouverture (52) à travers laquelle tombent les médicaments distribués.

4. Appareil selon l'une quelconque des revendications 1, 2 ou 3, comprenant en outre un panneau tactile ou un clavier, en communication électrique avec le microprocesseur 26.

5. Appareil selon l'une quelconque des revendications 1 à 4, comprenant en outre des moyens d'identification (32) d'un utilisateur.

6. Appareil selon la revendication 5, dans lequel les moyens d'identification (32) sont un lecteur de cartes.

7. Appareil selon l'une quelconque des revendications précédentes, comprenant en outre un compartiment de stockage pour un médicament, d'une forme particulière.

8. Appareil selon l'une quelconque des revendications précédentes, comprenant en outre un compartiment de stockage pour les médicaments retournés.

9. Appareil selon l'une quelconque des revendications précédentes, dans lequel le boîtier est formé à partir d'une structure en boîte, avec une ouverture supérieure et un couvercle (40) qui peut être ouvert et fermé sur l'ouverture, et une unité de commande (300) est pourvue du microprocesseur afin de commander les distributeurs et le boîtier, cette unité de commande comprenant une section d'identification (247) utilisant des mots de passe, des cartes à circuits intégrés, ou d'autres méthodes d'identification analogues pour permettre l'identification des utilisateurs, une unité d'entrée (248) pour entrer le type et le nombre de médicaments à distribuer depuis le boîtier (12), une unité de mémoire (249) pour enregistrer les données de l'unité d'entrée, et une section de distribution (10) pour distribuer automatiquement le type et le nombre requis de médicaments depuis le boîtier en se basant sur les informations désignées par l'unité d'entrée.

10. Appareil selon l'une quelconque des revendications précédentes, dans lequel au moins un distributeur abrite une cartouche qui contient des réceptacles à médicaments, ledit distributeur comportant une plateforme de distribution (86) alimentée par gravité, et un bras d'actionnement (82) pour repousser des réceptacles à médicaments hors de la plateforme de distribution, et la cartouche comprenant :
    - un réceptacle comportant une paroi frontale (92), une paroi arrière (94), deux parois latérales (96), un sommet (98) et un fond ouvert (100), et définissant un intérieur, le réceptacle ayant une taille propre à recevoir à l'intérieur les réceptacles à médicaments (108) ;
    - la paroi frontale (92) du récipient présentant une ouverture (104) qui s'étend vers le haut depuis le fond ouvert, l'ouverture frontale ayant une taille propre à recevoir un élément de retenue (110) qui présente une partie (114) s'étendant à l'intérieur du réceptacle pour retenir les réceptacles à médicaments (108) à l'intérieur du récipient ; et
    - l'élément de retenue (110) étant en outre attaché de façon amovible sur l'extérieur du récipient et comprenant une partie qui s'étend vers le haut depuis la partie s'étendant vers l'intérieur, de sorte que l'élément de retenue peut être enlevé du récipient en tirant la partie qui s'étend vers le haut.

11. Appareil selon la revendication 10, dans lequel l'élément de retenue (110) a généralement une forme en T, la partie qui s'étend vers l'intérieur étant une zone à largeur augmentée.

12. Appareil selon l'une ou l'autre des revendications 10 et 11, dans lequel le récipient et l'élément de retenue (110) définissent une pluralité d'ouvertures (126, 128) à travers lesquelles s'étend un fil (124) afin d'attacher l'élément de retenue sur le récipient.

13. Appareil selon l'une quelconque des revendications 10, 11 ou 12, dans lequel le récipient est réalisé en métal.

14. Appareil selon l'une quelconque des revendications 10, 11 ou 12, dans lequel le récipient est réalisé en matière plastique.

15. Appareil selon l'une quelconque des revendications 10, 11 ou 12, dans lequel l'élément de retenue est réalisé en acier à ressort.

16. Appareil selon l'une quelconque des revendications précédentes dans lequel au moins un distributeur comprend :
    - un boîtier de distributeur (62) qui définit une chambre intérieure (64) pour recevoir une cartouche (90) qui contient à l'intérieur des réceptacles à médicaments ;
    - le boîtier définissant en outre une plateforme de distribution (86) juxtaposée par rapport à la chambre intérieure, la plateforme de distribution définissant une ouverture (88) décalée par rapport à la chambre intérieure ;
    - un actionneur (68) activé de façon électronique et contenu en relation de coopération vis-à-vis de la plateforme de distribution (86), de sorte que les réceptacles à médicaments (108) qui reposent sur la plateforme de distribution peuvent être repoussés vers l'ouverture définie (88) ; et
    - un connecteur électrique (78) en communication électronique avec l'actionneur (68) et avec le microprocesseur (26) et adapté à être attaché en coopération avec le connecteur électrique (56) dans l'appareil distributeur (70).

17. Appareil selon la revendication 16, dans lequel l'actionneur (68) comprend un solénoïde ou un

moteur.

18. Appareil selon la revendication 17, dans lequel l'actionneur comprend en outre un bras d'actionneur (82) commandé par le solénoïde ou le moteur.

19. Appareil selon l'une ou l'autre des revendications 16 et 17, comprenant en outre un lecteur optique (66) en communication électronique avec le connecteur électrique (78) et placé au-dessus de l'ouverture définie (88) dans la plateforme de distribution.

FIG. 1

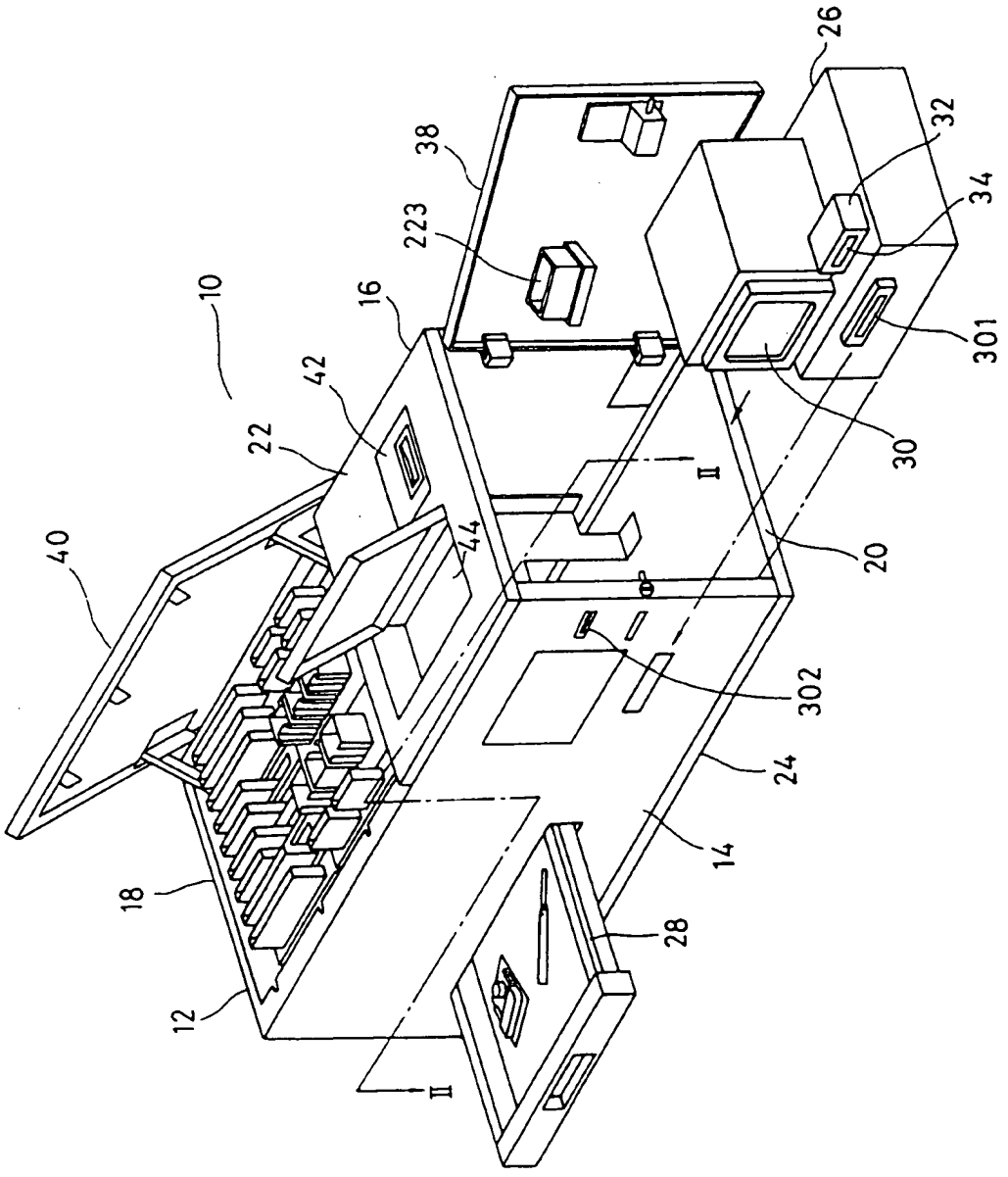


FIG. 2

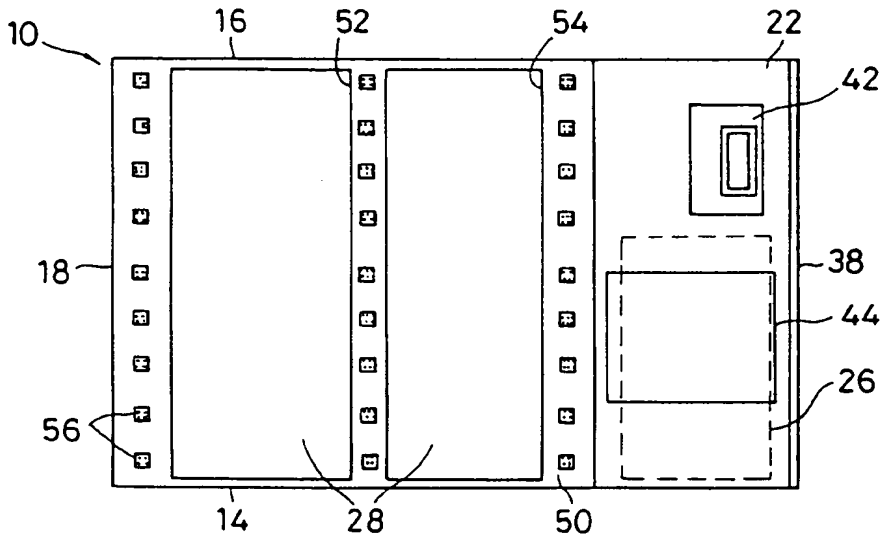

10
16
52
54
22
42
18
38
44
26
56
14
28
50

FIG. 11

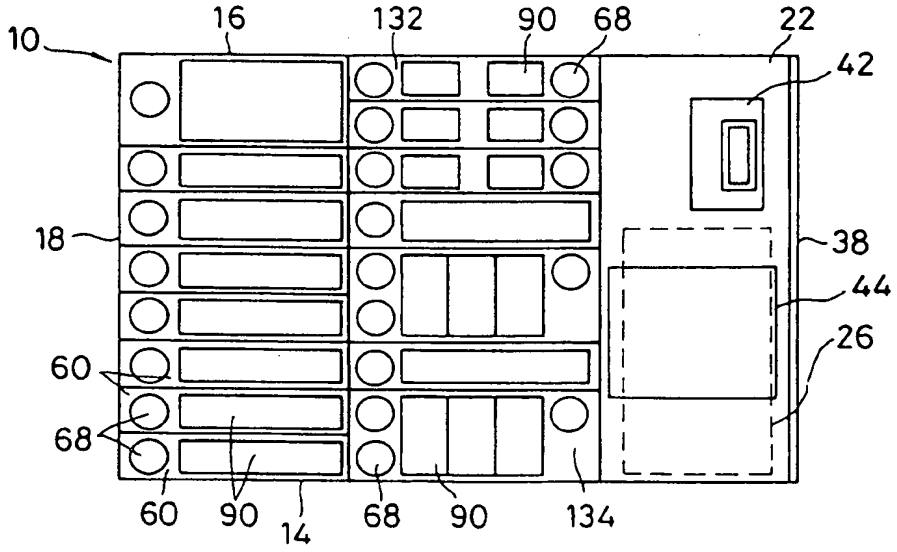

10
16
132
90
68
22
42
18
38
44
26
60
68
60
90
14
68
90
134

FIG. 3

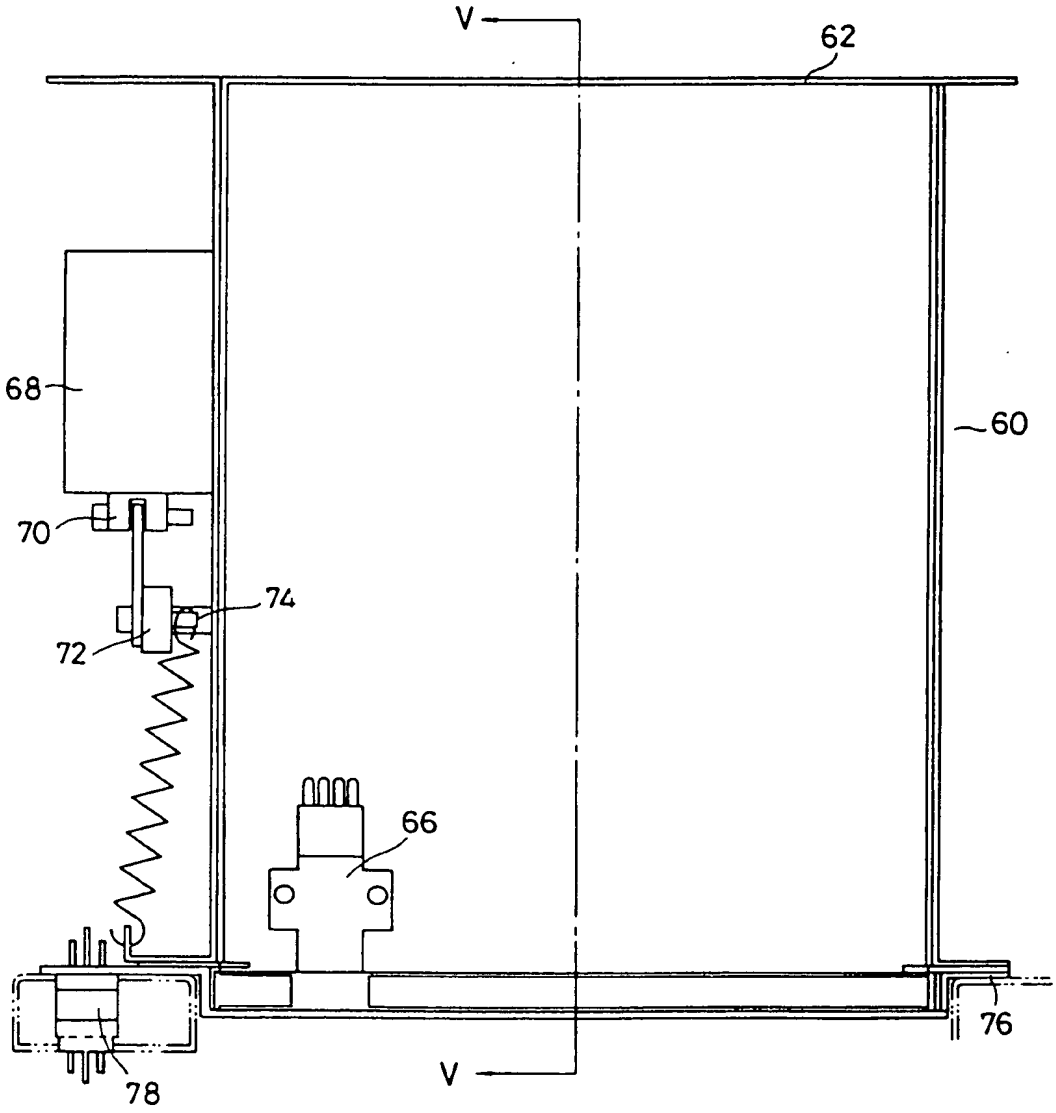


FIG. 4

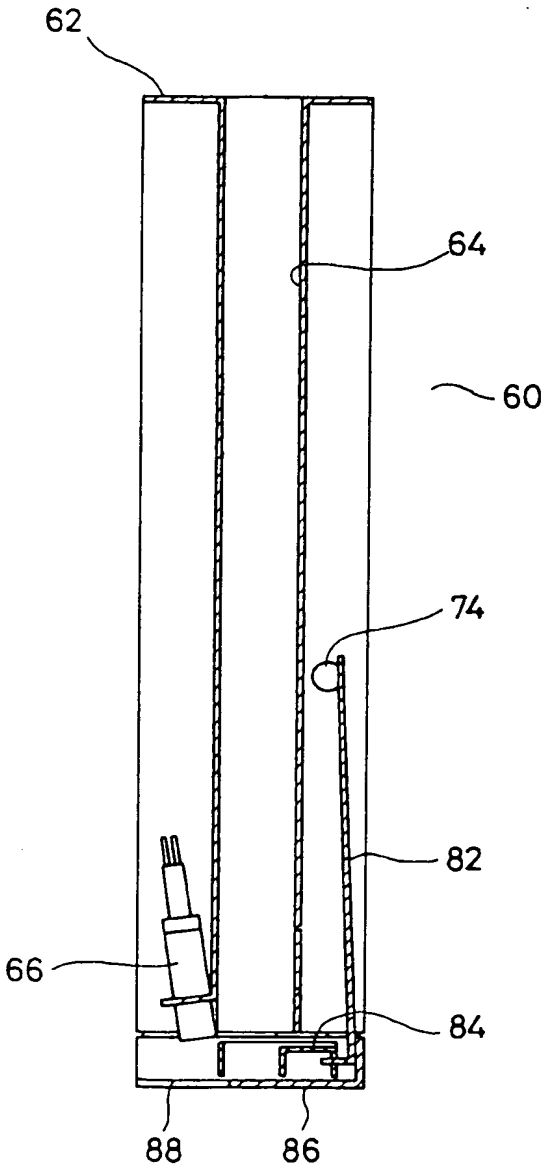


FIG. 5

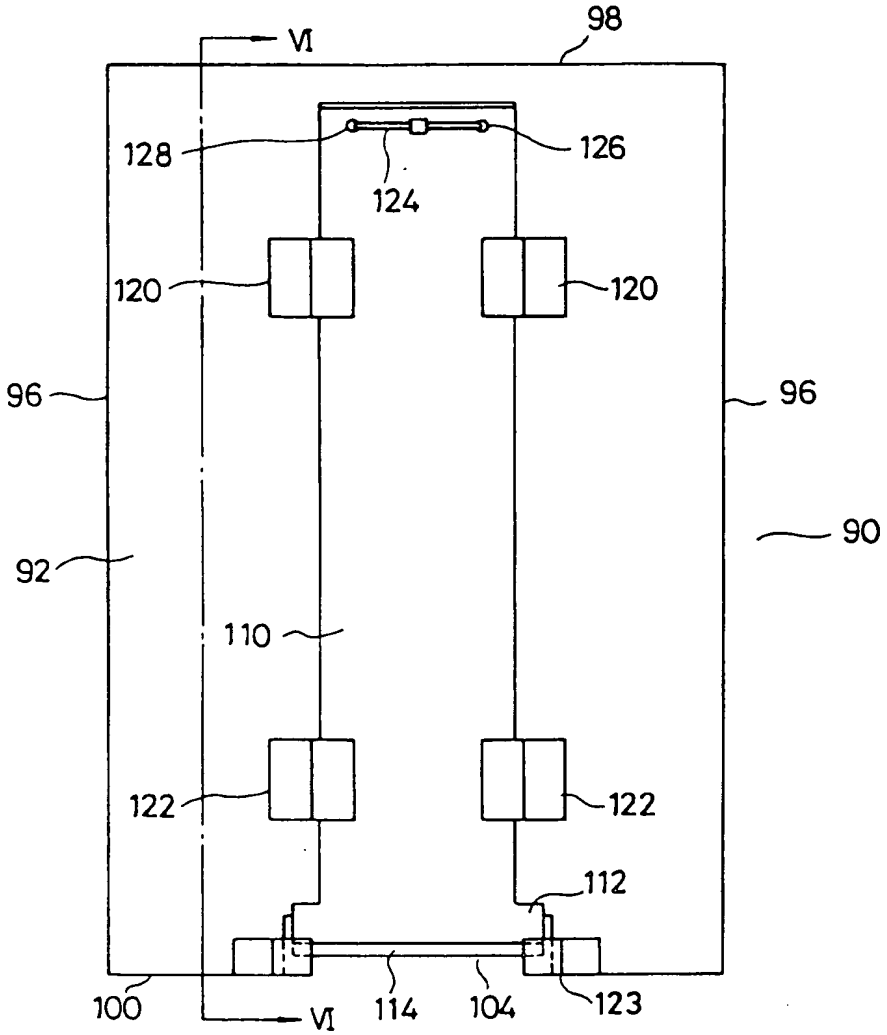

VI
98
128
126
124
120
120
96
96
90
92
110
122
122
112
100
VI
114
104
123

FIG. 7

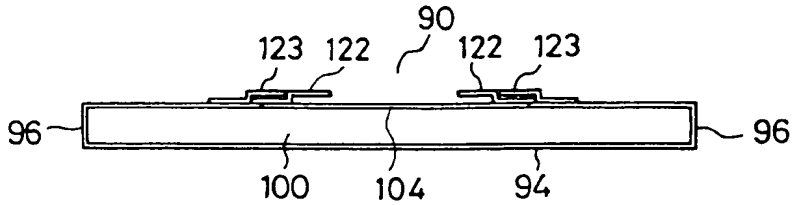

90
123
122
122
123
96
96
100
104
94

FIG. 6

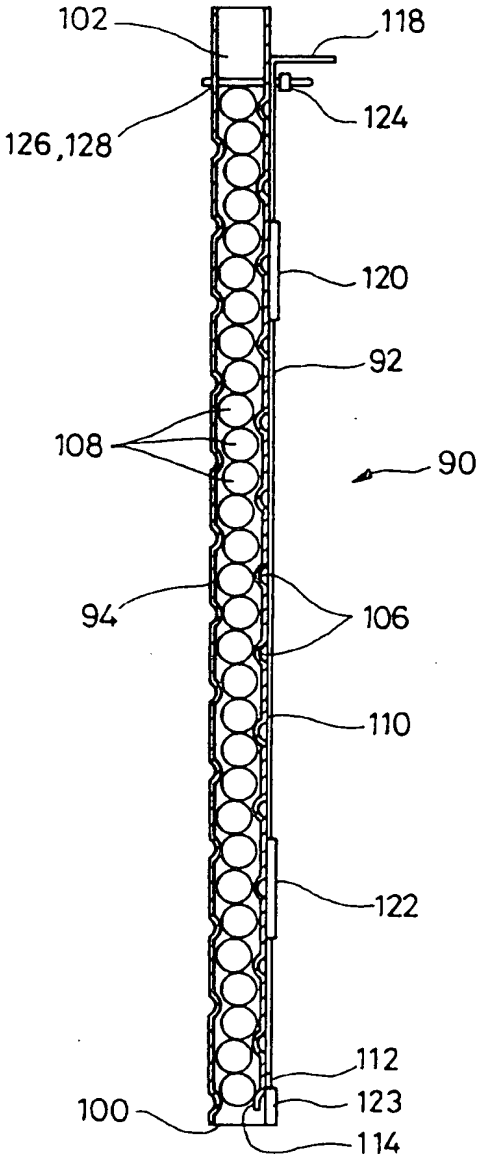


FIG. 8

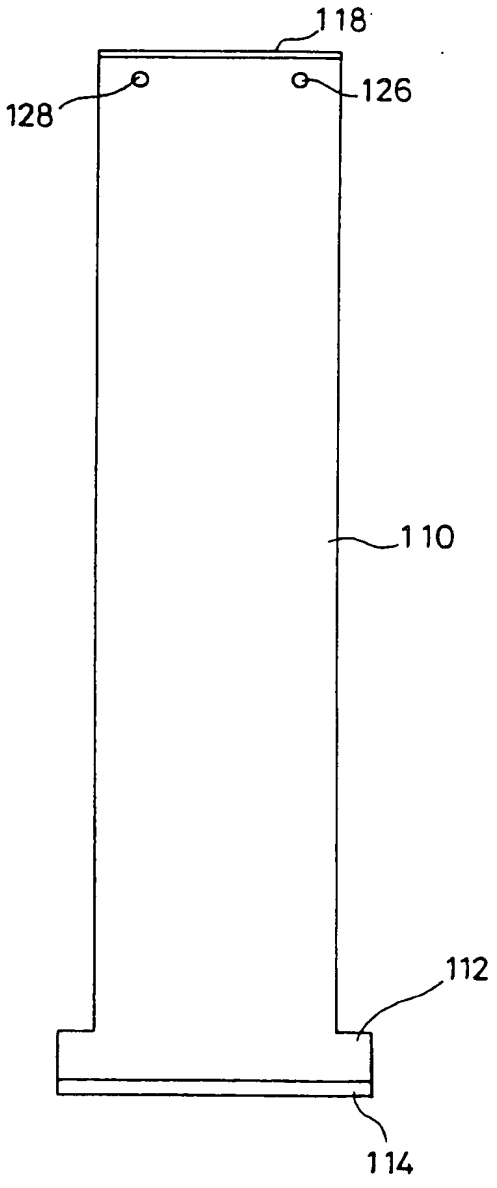


FIG. 9

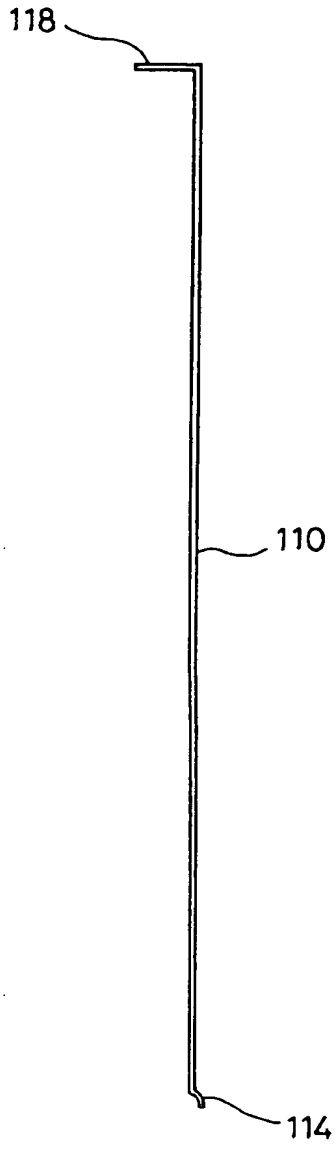


FIG. 10

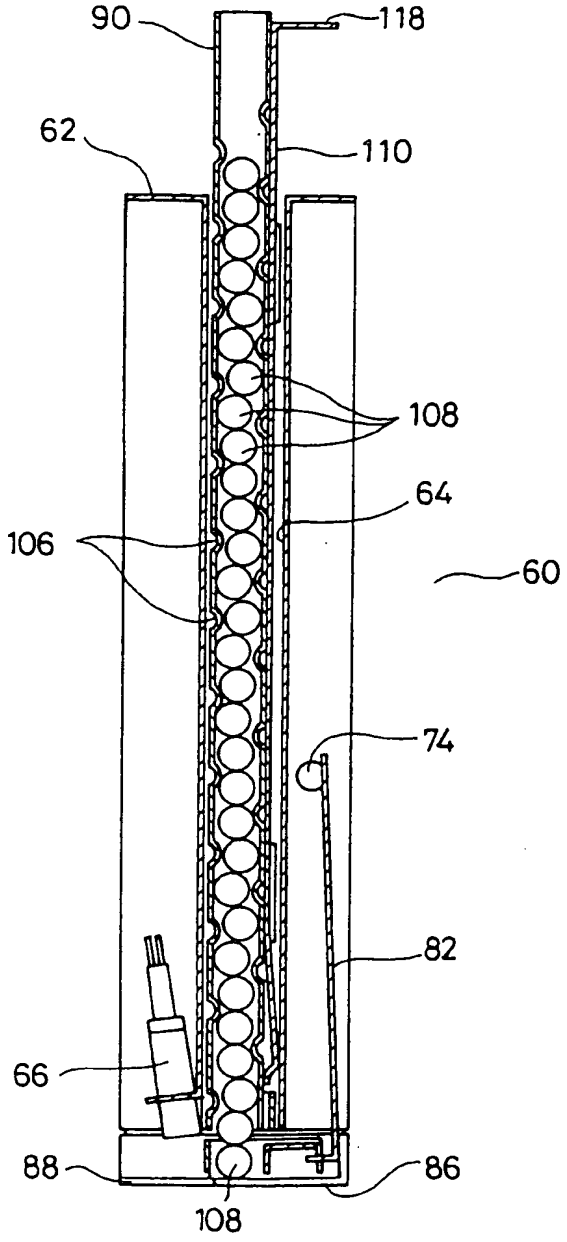


FIG. 12

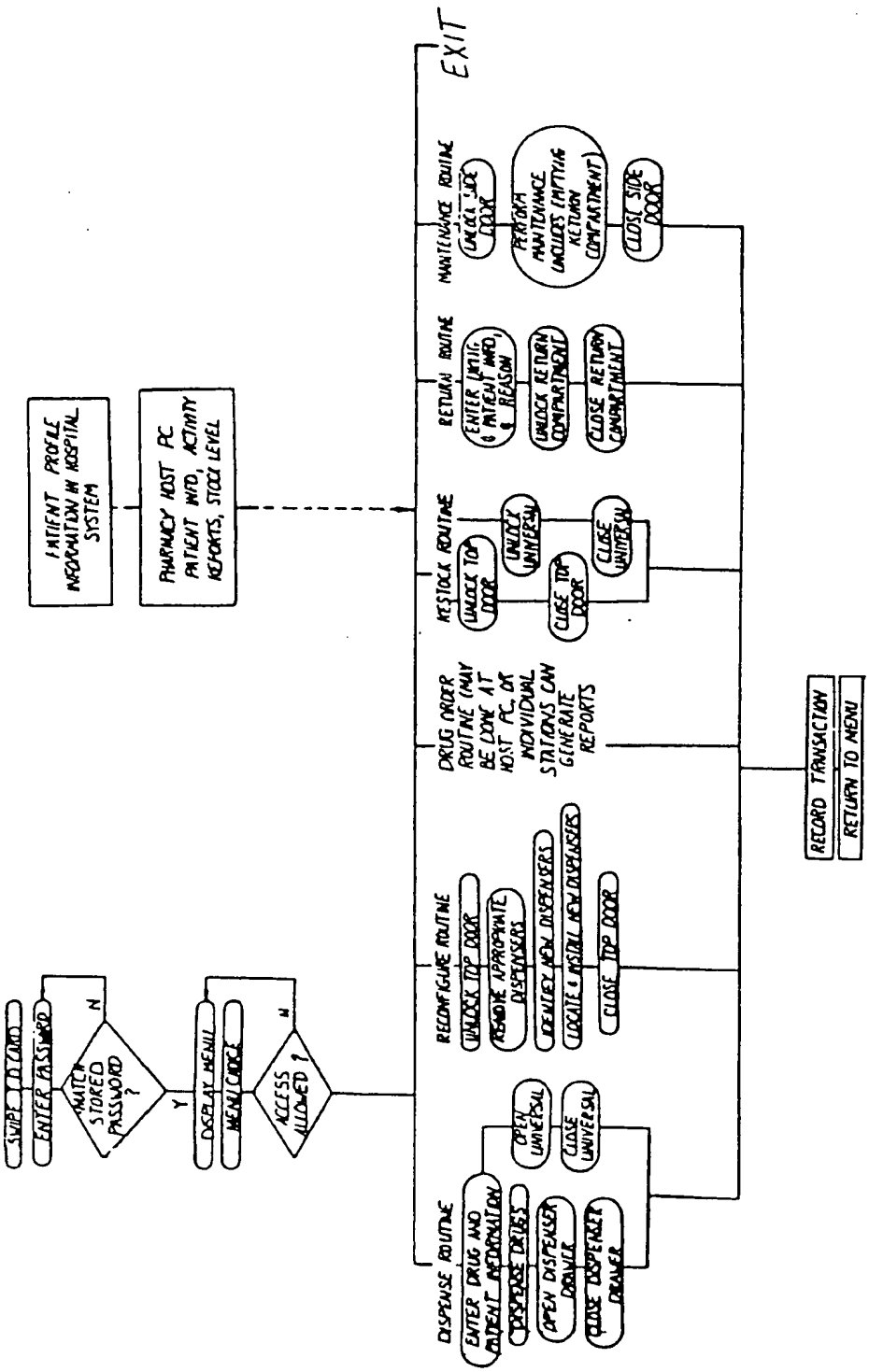

SWIPE BADGE
ENTER PASSWORD
MATCH STORED PASSWORD ?
N
Y
DISPLAY MENU
MENU CHOICE
ACCESS ALLOWED ?
N
INITIATE PROFILE INFORMATION IN HOSPITAL SYSTEM
PHARMACY HOST PC PATIENT INFO, ACTIVITY REPORTS, STOCK LEVEL
DISPENSE ROUTINE
ENTER DRUG AND PATIENT INFORMATION
DISPENSE DRUGS
OPEN DISPENSER DRAWER
CLOSE DISPENSER DRAWER
OPEN UNIVERSAL
CLOSE UNIVERSAL
RECONFIGURE ROUTINE
UNLOCK TOP DOOR
REMOVE APPROPRIATE DISPENSERS
IDENTIFY NEW DISPENSERS
LOCATE & INSTALL NEW DISPENSERS
CLOSE TOP DOOR
DRUG ORDER ROUTINE (MAY BE DONE AT HOST PC, OR INDIVIDUAL STATIONS CAN GENERATE REPORTS
RESTOCK ROUTINE
UNLOCK TOP DOOR
UNLOCK UNIVERSAL
CLOSE TOP DOOR
CLOSE UNIVERSAL
RETURN ROUTINE
ENTER UNIQ (PATIENT INFO, & REASON)
UNLOCK RETURN COMPARTMENT
CLOSE RETURN COMPARTMENT
MAINTENANCE ROUTINE
UNLOCK SIDE DOOR
PERFORM MAINTENANCE (ACCESS LIMITING RETURN COMPARTMENT)
CLOSE SIDE DOOR
EXIT
RECORD TRANSACTION
RETURN TO MENU

FIG. 13

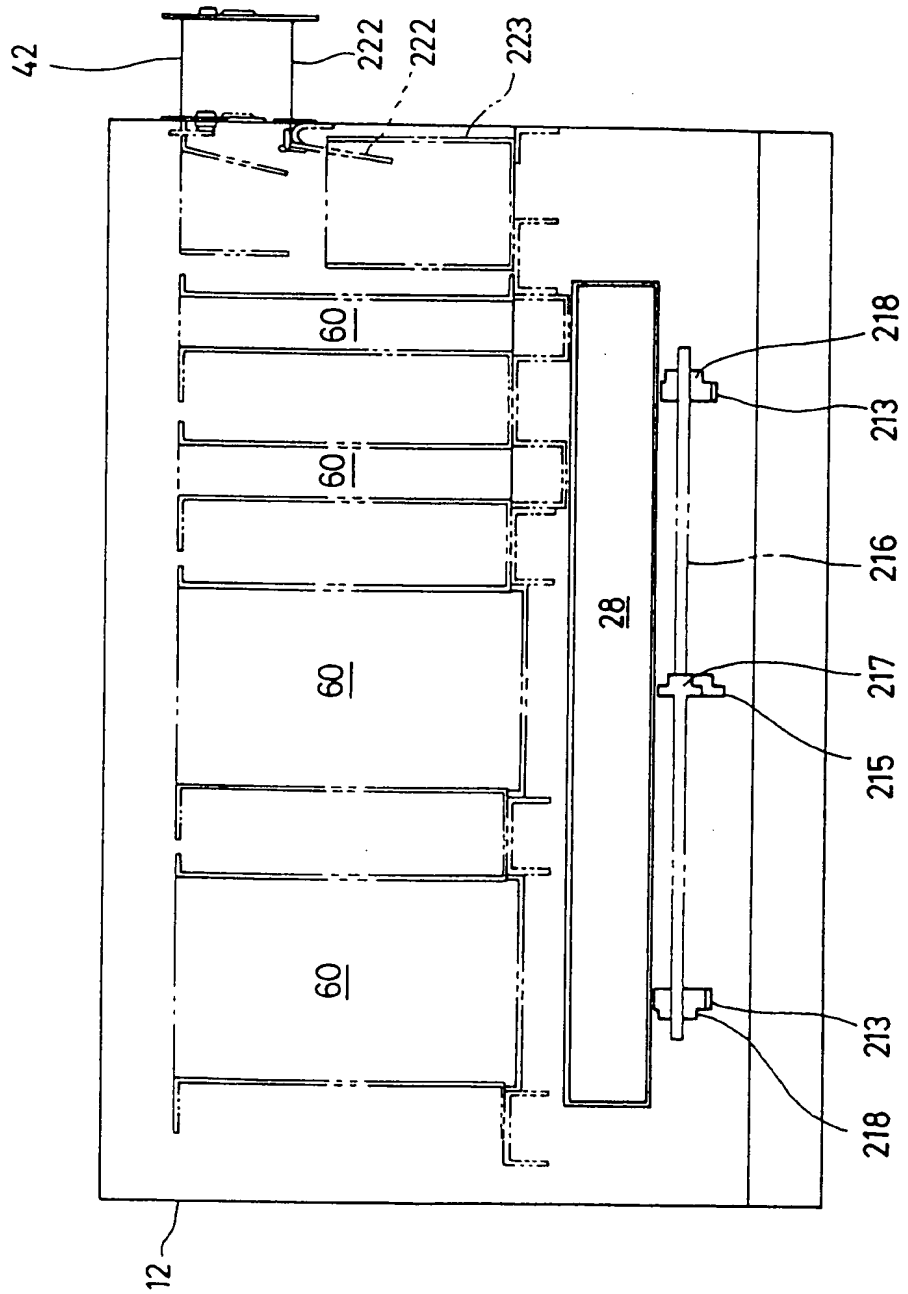


FIG. 14

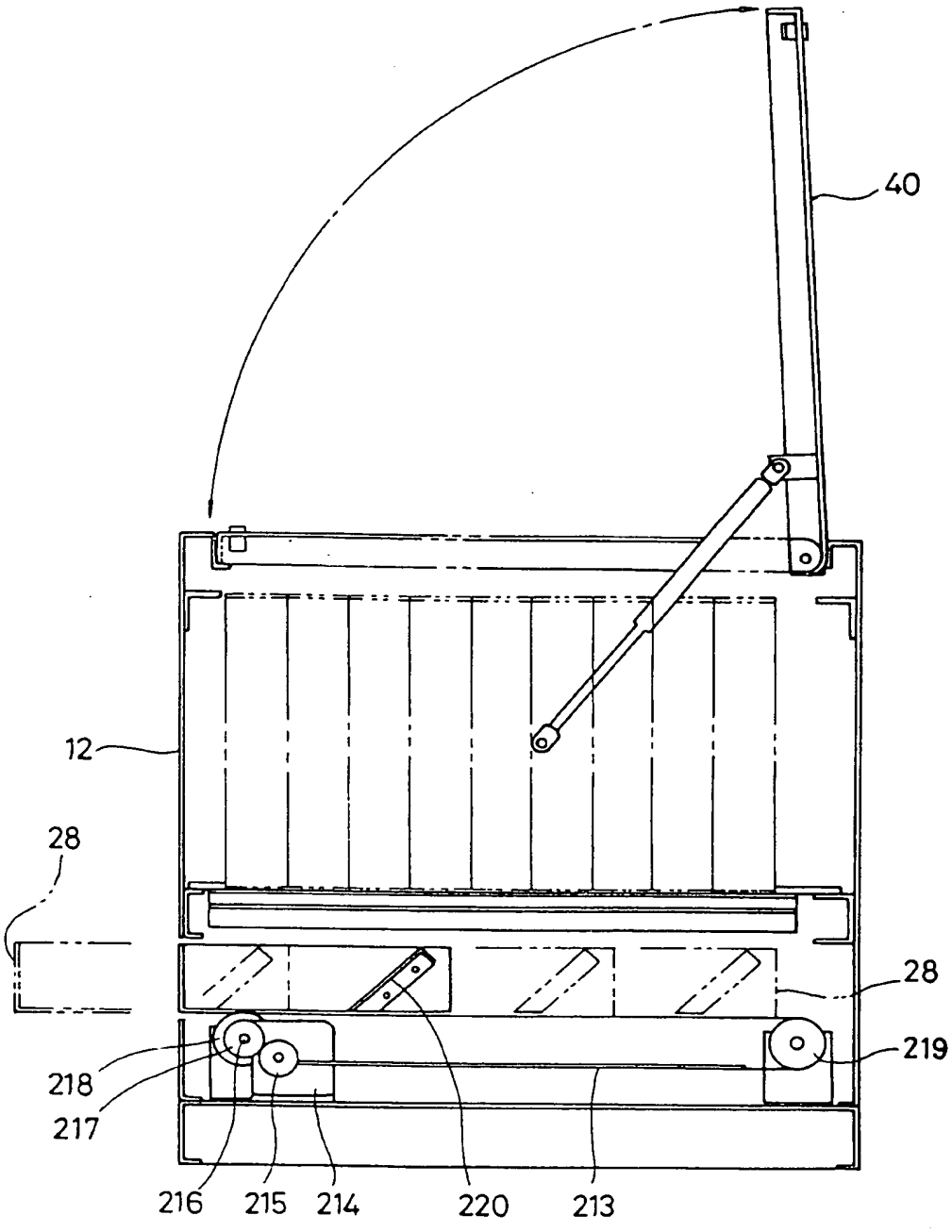


FIG. 15

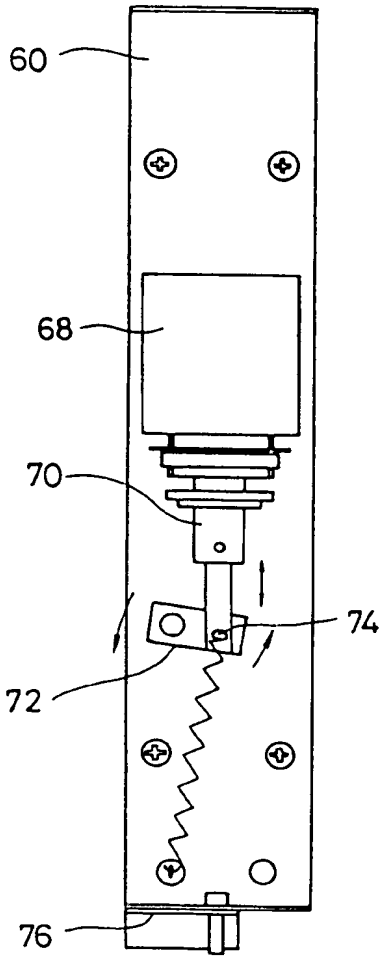


FIG. 17

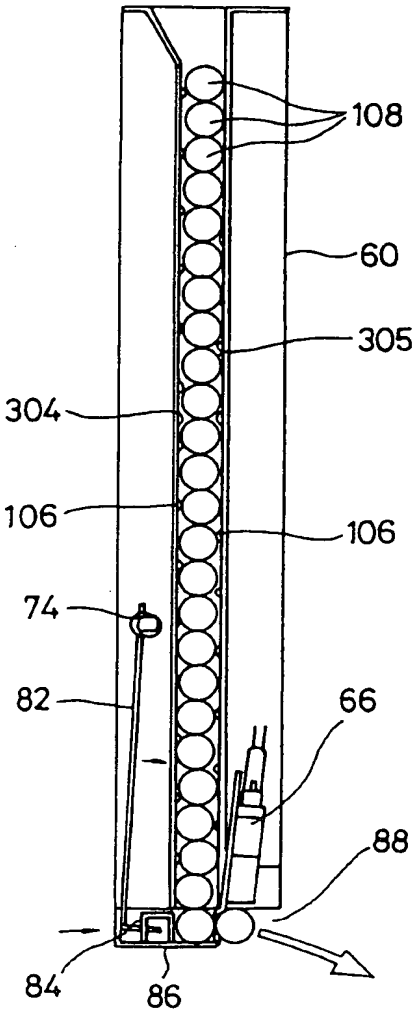


FIG. 16

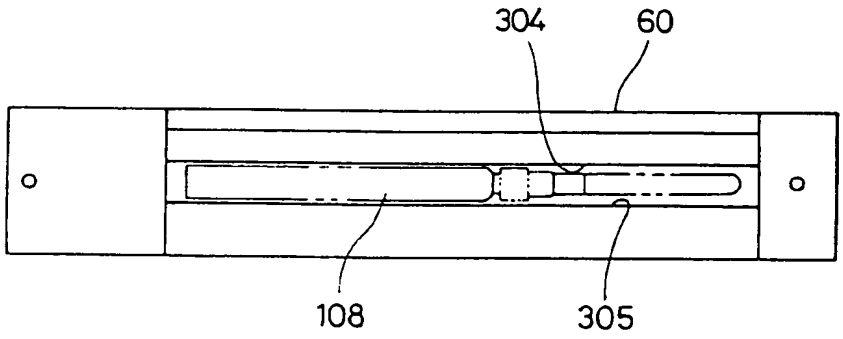


FIG. 18

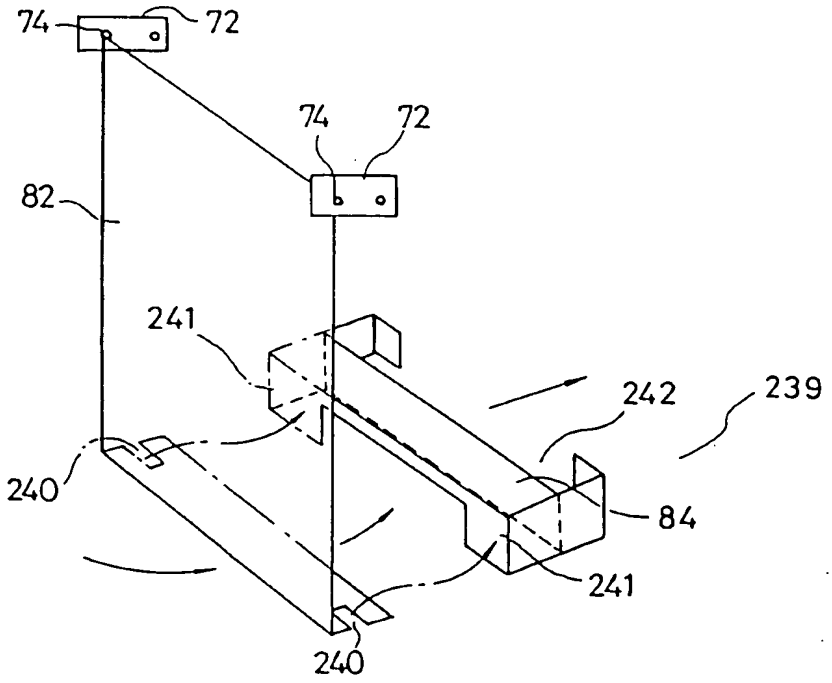
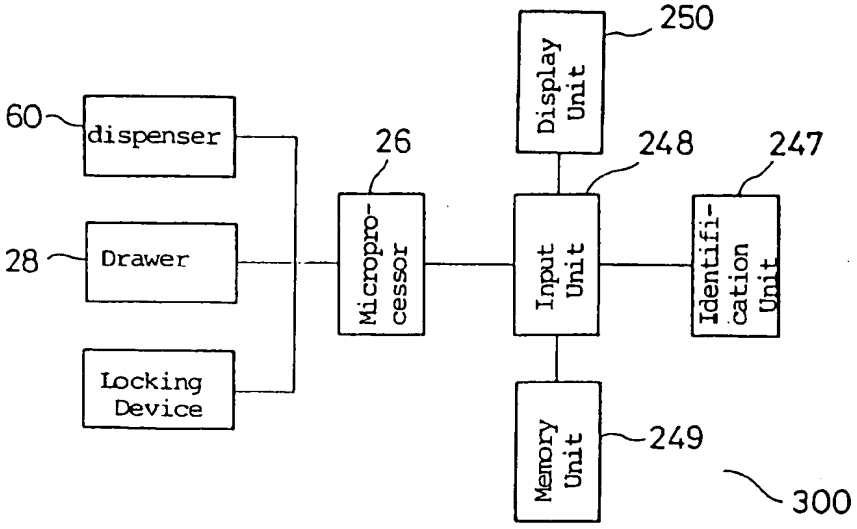

74
72
74
72
82
241
242
239
240
84
241
240

FIG. 19


60
dispenser
28
Drawer
Locking Device
26
Microprocessor
250
Display Unit
248
Input Unit
247
Identification Unit
Memory Unit
249
300